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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Tiancun XIAO

Serial No.: 10/588,156

Filed: August 1, 2006

CATALYTIC REACTION BETWEEN  
METHANOL AND A PEROXIDE



) PATENT  
)  
) GROUP: 1793  
)  
) EXAMINER: LANGEL, W. A.  
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) CUSTOMER NO.: 25269  
)  
CONFIRMATION NO. 9209

DECLARATION UNDER 37 C.F.R. 1.132

I, Tiancun Xiao, who am a British citizen, hereby declare and state as follows.

1. I am the named inventor of the invention described and claimed in the above-identified patent application.
2. I attended Lanzhou Institute of Chemical Physics, Chinese Academy of Sciences from 1987 to 1993, and was awarded Ph.D Degree in Chemistry in 1993.
3. I was employed by University of Oxford as a research fellow to do research and supervise the students from 2001-2006.
4. I have reviewed the prosecution history of the above-identified patent application, including the final Office Action of October 13, 2009 and the Advisory Action of January 13, 2010, and now describe the following experimentation to demonstrate the patentability of the present application relative to the cited Oroskar et al. patent.

## Experimental Procedure

First, an experiment was carried out in accordance with the teaching of Oroskar et al. using the preferred  $\text{MnO}_2$  catalyst disclosed on column 6, line 53.

$\text{MnO}_2$  was obtained from BDH having a purity of >99%.  $\text{H}_2\text{O}_2/\text{H}_2\text{O}$  (35 wt%) was obtained from Aldrich (stabilized). Methanol was obtained (analytical purity). The  $\text{MnO}_2$  (0.12g) was loaded in a glass tube (6mm outside diameter) which was plugged with quartz wool.

$\text{H}_2\text{O}_2$  was mixed at room temperature in a glass flask with  $\text{CH}_3\text{OH}$  at mol ratios  $1\text{H}_2\text{O}_2:1\text{CH}_3\text{OH}$  (mixture 1) for  $\text{H}_2$  generation, and  $3\text{H}_2\text{O}_2:1\text{CH}_3\text{OH}$  (mixture 2) for steam generation. The liquid mixture was delivered downwards to the catalyst bed at 0.15ml/min. The temperature of the catalyst bed was monitored using a K-type thermal couple. The exit gas products were analyzed using an on-line GC equipped with TCD and FID detectors.

When flowing mixture 1 into the reactor system, the catalyst bed temperature increased from ambient temperature ( $20^\circ\text{C}$ ) to  $72^\circ\text{C}$ , some liquid flowed through the catalyst with gases. GC analysis showed that  $\text{O}_2$  was produced, while FID showed that methanol was present in the gas stream, which was untreated.

When flowing mixture 2 into the reactor system, the catalyst bed temperature increased to 80°C. Again some liquid flowed through the catalyst bed, with O<sub>2</sub> gases and methanol vapors.

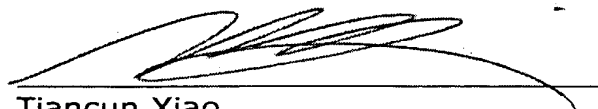
A second experiment was carried out in accordance with the present invention. Pt/Al<sub>2</sub>O<sub>3</sub> was prepared in our laboratory and the above experiment repeated but replacing the MnO<sub>2</sub> catalyst with the Pt/Al<sub>2</sub>O<sub>3</sub> catalyst. In contrast to the results obtained with MnO<sub>2</sub>, the Pt/Al<sub>2</sub>O<sub>3</sub> catalyst gave CO<sub>2</sub> and H<sub>2</sub> in the products, and the catalyst bed temperature was more than 100°C when flowing the mixtures over them.

### Conclusions

The experiments demonstrated that elemental platinum metal catalyst was able to initiate a reaction between methanol and hydrogen peroxide in the liquid phase at ambient temperature to provide a gas. In contrast, the MnO<sub>2</sub> catalyst did not initiate the reaction. Instead it catalyzed a decomposition of the hydrogen peroxide to water and oxygen, leaving the methanol unreacted.

I furthermore declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false

statements may jeopardize the validity of the application or any patent issued thereon.

  
Tiancun Xiao

Feb. 09, 2010  
Date

